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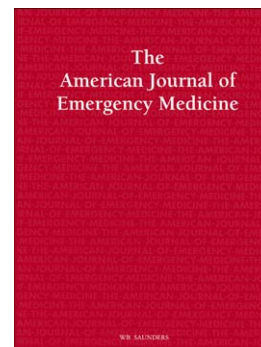
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**Multiple trauma, resuscitation and 15 minutes of esophageal intubation:
survival without neurological deficit**

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Running title: Intact survival after hypoxic cardiac arrest

Our air rescue service was called to an underground construction site for a 22 years old patient with multiple traumata after a 13 meters fall. Because of the danger and the safety-regulations on the scene, the local rescue practitioners treated the patient and brought him to our rescue team on the surface 60 min. after the trauma and 15 min. after intubation. Our first encounter showed an obviously severely injured patient. To anticipate later diagnostics, he showed open craniofacial injury with pneumocephalon, open arm fractures, blunt chest trauma, abdominal injury with liver hematoma, traumatic inguinal hernia (ileum), perforated large bowel and pelvic fracture. We followed the ABCDE approach and saw A: estimated tracheal intubation, B: symmetrical rising of the chest, choking, with manual bag to tube ventilation, $etCO_2$ 0 kPa, SpO_2 showed pulse pletysmography without oxygen value, C: no ECG attached, palpable central pulse 100 / min., large bore venous access, D: Glasgow coma scale 3, pupils equal 5 mm reactive to light, sedation with midazolam and ketamine to facilitate "intubation" 15 min. earlier; no paralytic agent was given, E: severely injured patient with a tense abdomen. We immediately attached an ECG, which now showed a slow broad complex rhythm without palpable pulse, consistent with pulseless electric activity (PEA) and manual chest compression (CPR) was started. One mg of adrenaline (epinephrine) was given intravenously according to PEA algorithm. Reassessment indicated an absent chest rise despite bag ventilation. On enquiry we found that $etCO_2$ was 0 kPa since the initial intubation 15 min. earlier. Under CPR the tube was removed from the esophagus and mask ventilation initiated without any difficulty. SpO_2 climbed to 80% and the patient regained spontaneous circulation. CPR was stopped after 90 sec. in total. One successful attempt of orotracheal intubation was performed (Cormack and Lehane grade 3) and manual ventilation over the endotracheal tube begun with 100% oxygen. Thereafter SpO_2 reached 100 % and the first $etCO_2$ was 6.8 kPa (measured with the same

equipment). Mechanical ventilation was initiated. Circulation was stable without further inotropic support. After helicopter transport to the hospital, the patient received damage control surgery, was extubated on day 8 after the event and left the hospital 2 months later without any neurological deficit.

Unrecognized esophageal intubation is frequent [1], and traumatic PEA resuscitation is often futile [2], so there are 3 messages we want to address:

1. Stay with the algorithms, reassess and think of reversible causes, even if the situation seems crystal clear [3]
2. Use capnography after endotracheal intubation [4], do not accept technical problems for absent expiratory CO₂ [1], “if in doubt take it out”
3. Use the “silver standard” (laryngeal mask, laryngeal tube, or just mask ventilation), if the gold standard is not successful [4,5]

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Legend Figure 1:

Chronology of the accident and rescue mission

“Legend: PEA: pulseless electrical activity, CPR: cardiopulmonary resuscitation,
ROSC: return of spontaneous circulation, etCO₂: endtidal CO₂”

ACCEPTED MANUSCRIPT

